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Abstract

TITLE: Environmental impact specification for direct space weathering of Kuiper Belt and Oort Cloud objects

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ABSTRACT BODY: The Direct Space Weathering Project of NASA's Outer Planets Research Program addresses specification of the plasma and energetic particle environments for irradiation and surface chemical processing of icy bodies in the outer solar system and the local interstellar medium. Knowledge of the radiation environments is being expanded by ongoing penetration of the twin Voyager spacecraft into the heliosheath boundary region of the outer heliosphere and expected emergence within the next decade into the very local interstellar medium. The Voyager measurements are being supplemented by remote sensing from Earth orbit of energetic neutral atom emission from this boundary region by NASA's Interstellar Boundary Explorer (IBEX). Although the Voyagers long ago passed the region of the Classical Kuiper Belt, the New Horizons spacecraft will encounter Pluto in 2015 and thereafter explore one or more KBOs, meanwhile providing updated measurements of the heliospheric radiation environment in this region. Modeling of ion transport within the heliosphere allows specification of time-integrated irradiation effects while the combination of Voyager and IBEX data supports projection of the in-situ measurements into interstellar space beyond the heliosheath. Transformation of model ion flux distributions into surface sputtering and volume ionization profiles provides a multi-layer perspective for space weathering impact on the affected icy bodies and may account for some aspects of color and compositional diversity. Other important related factors may include surface erosion and gardening by meteoritic impacts and surface renewal by cryovolcanism. Chemical products of space weathering may contribute to energy resources for the latter.

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